acts from being put through them. The experiments indicate the presence of mental images. Miss Isabel McCracken, in studying "The Egg-laying Apparatus in the Silkworm (*Bombyx mori*) as a Reflex Apparatus," performed various operations on the nervous system to learn the localization of function in the egg-laying reflexes. The posterior abdominal ganglion is the controlling center and exhibits a high degree of independent activity. The vitality of the silkworm moth, as measured by length of life and capacity of the reproductive system to function, is not impaired by removal of the head. The exact influence upon the reproductive function of the cerebral, thoracic and the several abdominal ganglia was experimentally determined. "A Study of the Choroid Plexus," by Walter J. Meek, adds confirmatory evidence to the conclusion that the plexuses are concerned in the secretion of the cerebro-spinal fluid.

SOCIETIES AND ACADEMIES

THE ST. LOUIS CHEMICAL SOCIETY

At the meeting of the St. Louis Chemical Society, held June 10, three papers were presented on the general subject "The Fixation of Atmospheric Nitrogen."

1. "By Plants," J. Arthur Harris, of the Missouri Botanical Gardens.

2. "By Direct Oxidation," Carl Hambuechen.

3. "As Ammonia and Cyanides," Dr. F. W. Frerichs.

The speakers presented the general history of the several processes, and the methods employed, together with an account of the present status of the subject. Dr. F. W. Frerichs concluded that even if the Chilean sources of combined nitrogen should be exhausted within twenty-five years, and even if the low nitrogen content of mineral coal (about 2 per cent.) excluded this as a source of combined nitrogen, except in the few cases in which this nitrogen can be obtained as a by-product, still, chemistry will be quite able to supply all the combined nitrogen that shall be required.

C. J. Borgmeyer,
Corresponding Secretary

DISCUSSION AND CORRESPONDENCE

DR. EASTMAN'S RECENT PAPERS ON THE KINSHIP OF THE ARTHRODIRES[1]

Every one who labors with the time-honored problem of vertebrate descent must consider, sooner or later, the arthrodiran "fishes," for these, with forms similar but even more puzzling, were the most conspicuous and diversified of earliest chordates. They are first known in the upper Silurian, run their gamut of evolutional prosperity in the middle Devonian, and become extinct in the early Carboniferous: the earlier forms were small with tubercle-like teeth, the later, often of considerable size, with many types of dentition, tubercular, trenchant, or crushing. Unhappily, however, the various forms of arthrodires are known only imperfectly, and the fact that various writers have considered them as related to almost every and widely separated groups of living fishes is enough to indicate how little is known of their anatomy.

Among the latest contributions to this unsatisfactory theme are three papers by Dr. C. R. Eastman, and these contain such reactionary views as to the kinship of arthrodires that they merit a somewhat extended review. For, in the matter of vertebrate descent, there should, I think, be entered a friendly protest against Eastman's conclusions—all the more necessary on account of his deservedly high authority in matters of palæichthyology—and the reasons should be summarized for regarding his arguments inadequate. On the other hand, I do not believe that this is the place to support in detail a rival theory—it is rather to show the intricacy of the materials involved and the limitations to which our conclusions must be subject.

Eastman brings out in his papers three essential theses. He aims to demonstrate: (1) That arthrodires are specialized lung-fishes, principally on the evidence of dental plates and

[1] "Dipnoan Affinities of Arthrodires," *Am. Jour. Sci.*, Vol. XXI., February, 1906. "Structure and Relations of Mylostoma," *Bull. Mus. Comp. Zool.*, Vol. L., No. I., pp. 1–34, pls. 1–5, May, 1906. "Mylostomid Dentition," *ibid.*, Vol. L., No. 7, pp. 211–229, 1 pl., February, 1907.